

**What Is Claimed Is:**

1           1.       A method for detecting a thermal anomaly in a computer system,  
2 comprising:  
3           deriving an estimated signal for a thermal sensor in the computer system,  
4 wherein the estimated signal is derived from correlations with other  
5 instrumentation signals in the computer system;  
6           comparing an actual signal from the thermal sensor with the estimated  
7 signal to determine whether a thermal anomaly exists in the computer system; and  
8           if a thermal anomaly exists, generating an alarm.

1           2.       The method of claim 1, wherein generating the alarm involves  
2 communicating the alarm to a system administrator so that the system  
3 administrator can take remedial action.

1           3.       The method of claim 2, wherein communicating the alarm to the  
2 system administrator involves communicating information specifying the nature  
3 of the thermal anomaly to the system administrator.

1           4.       The method of claim 1, wherein comparing the actual signal with  
2 the estimated signal involves using sequential detection methods to detect changes  
3 in the relationship between the actual signal and the estimated signal.

1           5.       The method of claim 4, wherein the sequential detection methods  
2 include the Sequential Probability Ratio Test (SPRT).

1           6.       The method of claim 1, wherein prior to deriving the estimated  
2    signal, the method further comprises determining correlations between  
3    instrumentation signals in the computer system, whereby the correlations can  
4    subsequently be used to generate estimated signals for thermal sensors.

1           7.       The method of claim 6, wherein determining the correlations  
2    involves using a non-linear, non-parametric regression technique to determine the  
3    correlations.

1           8.       The method of claim 7, wherein the non-linear, non-parametric  
2    regression technique can include a multivariate state estimation technique.

1           9.       The method of claim 1, wherein the instrumentation signals can  
2    include:  
3            signals associated with internal performance parameters maintained by  
4    software within the computer system;  
5            signals associated with physical performance parameters measured  
6    through sensors within the computer system; and  
7            signals associated with canary performance parameters for synthetic user  
8    transactions, which are periodically generated for the purpose of measuring  
9    quality of service from an end user's perspective.

1           10.      The method of claim 1,  
2            wherein deriving the estimated signal for the thermal sensor involves  
3    deriving multiple estimated signals for multiple thermal sensors in the computer  
4    system; and

5            wherein comparing the actual signal with the estimated signal involves  
6       comparing multiple actual signals with the multiple estimated signals to determine  
7       whether a thermal anomaly exists in the computer system.

1            11.     A computer-readable storage medium storing instructions that  
2       when executed by a computer cause the computer to perform a method for  
3       detecting a thermal anomaly in a computer system, the method comprising:  
4            deriving an estimated signal for a thermal sensor in the computer system,  
5       wherein the estimated signal is derived from correlations with other  
6       instrumentation signals in the computer system;  
7            comparing an actual signal from the thermal sensor with the estimated  
8       signal to determine whether a thermal anomaly exists in the computer system; and  
9            if a thermal anomaly exists, generating an alarm.

1            12.     The computer-readable storage medium of claim 11, wherein  
2       generating the alarm involves communicating the alarm to a system administrator  
3       so that the system administrator can take remedial action.

1            13.     The computer-readable storage medium of claim 12, wherein  
2       communicating the alarm to the system administrator involves communicating  
3       information specifying the nature of the thermal anomaly to the system  
4       administrator.

1            14.     The computer-readable storage medium of claim 11, wherein  
2       comparing the actual signal with the estimated signal involves using sequential  
3       detection methods to detect changes in the relationship between the actual signal  
4       and the estimated signal.

1           15.     The computer-readable storage medium of claim 14, wherein the  
2 sequential detection methods include the Sequential Probability Ratio Test  
3 (SPRT).

1           16.     The computer-readable storage medium of claim 11, wherein prior  
2 to deriving the estimated signal, the method further comprises determining  
3 correlations between instrumentation signals in the computer system, whereby the  
4 correlations can subsequently be used to generate estimated signals.

1           17.     The computer-readable storage medium of claim 16, wherein  
2 determining the correlations involves using a non-linear, non-parametric  
3 regression technique to determine the correlations.

1           18.     The computer-readable storage medium of claim 17, wherein the  
2 non-linear, non-parametric regression technique can include a multivariate state  
3 estimation technique.

1           19.     The computer-readable storage medium of claim 11, wherein the  
2 instrumentation signals can include:  
3           signals associated with internal performance parameters maintained by  
4 software within the computer system;  
5           signals associated with physical performance parameters measured  
6 through sensors within the computer system; and  
7           signals associated with canary performance parameters for synthetic user  
8 transactions, which are periodically generated for the purpose of measuring  
9 quality of service from and end user's perspective.

1           20.     The computer-readable storage medium of claim 11,  
2           wherein deriving the estimated signal for the thermal sensor involves  
3     deriving multiple estimated signals for multiple thermal sensors in the computer  
4     system; and  
5           wherein comparing the actual signal with the estimated signal involves  
6     comparing multiple actual signals with the multiple estimated signals to determine  
7     whether a thermal anomaly exists in the computer system.

1           21.     An apparatus that detects a thermal anomaly in a computer system,  
2     comprising:  
3           an estimation mechanism configured to derive an estimated signal for a  
4     thermal sensor in the computer system, wherein the estimated signal is derived  
5     from correlations with other instrumentation signals in the computer system;  
6           a comparison mechanism configured to compare an actual signal from the  
7     thermal sensor with the estimated signal to determine whether a thermal anomaly  
8     exists in the computer system; and  
9           an alarm generation mechanism, wherein if a thermal anomaly exists, the  
10    alarm generation mechanism is configured to generate an alarm.

1           22.     The apparatus of claim 21, wherein the alarm generation  
2     mechanism is configured to communicate the alarm to a system administrator so  
3     that the system administrator can take remedial action.

1           23.     The apparatus of claim 22, wherein the alarm generation  
2     mechanism is configured to communicate information specifying the nature of the  
3     thermal anomaly to the system administrator.

1           24.     The apparatus of claim 21, wherein the comparison mechanism is  
2     configured to use sequential detection methods to detect changes in the  
3     relationship between the actual signal and the estimated signal.

1           25.     The apparatus of claim 24, wherein the sequential detection  
2     methods include the Sequential Probability Ratio Test (SPRT).

1           26.     The apparatus of claim 21, further comprising a correlation  
2     determination mechanism configured to determine correlations between  
3     instrumentation signals in the computer system, whereby the correlations can  
4     subsequently be used to generate estimated signals.

1           27.     The apparatus of claim 26, wherein the correlation determination  
2     mechanism is configured to use a non-linear, non-parametric regression technique  
3     to determine the correlations.

1           28.     The apparatus of claim 27, wherein the non-linear, non-parametric  
2     regression technique can include a multivariate state estimation technique.

1           29.     The apparatus of claim 21, wherein the instrumentation signals can  
2     include:  
3                 signals associated with internal performance parameters maintained by  
4     software within the computer system;  
5                 signals associated with physical performance parameters measured  
6     through sensors within the computer system; and

7 signals associated with canary performance parameters for synthetic user  
8 transactions, which are periodically generated for the purpose of measuring  
9 quality of service from an end user's perspective.

1 30. The apparatus of claim 21,  
2 wherein the estimation mechanism is configured to derive estimated  
3 signals for multiple thermal sensors in the computer system; and  
4 wherein the comparison mechanism is configured to compare multiple  
5 actual signals with the multiple estimated signals to determine whether a thermal  
6 anomaly exists in the computer system.